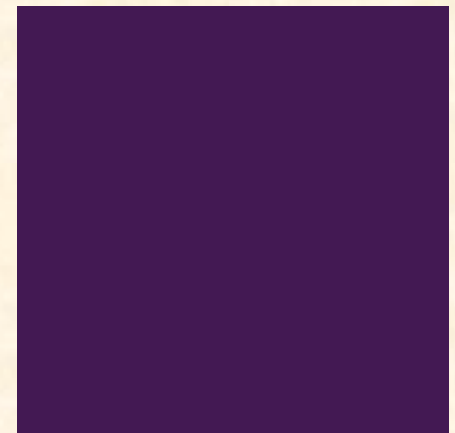
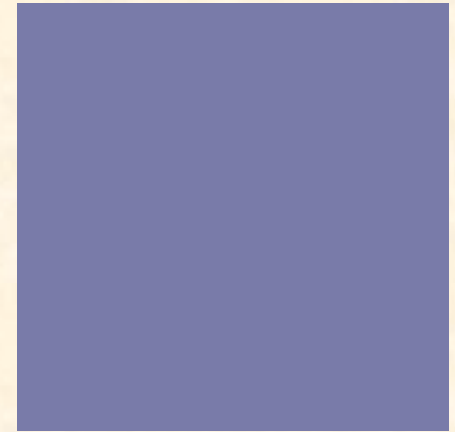




Residential Information and Controls Study

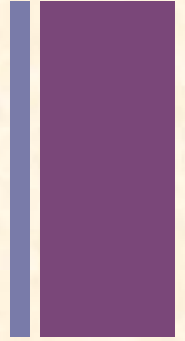
Project Status Update



August 26, 2011

Karen Herter, Ph.D.
Herter Energy
RESEARCH SOLUTIONS

+ Context and Goals



- SmartGrid Implementation – state and nationwide
- SmartGrid Promises
 - Improved system efficiency and reliability
 - Better informed, more involved, happier electricity customers
- SmartGrid Reality
 - Utilities struggling to communicate customer value proposition
 - High profile cost overruns and customer revolts
- Study Goal
 - Begin to investigate which information and control elements provide customer value – and which don't

+ Background: Small Business Summer Solutions

- 2008 Small Business EEDR Pilot*
 - 78 SMUD participants: Offices, Retail, Restaurants
 - Treatments: Thermostats + Education + CPP + ATC
 - Results:
 - 14% peak reduction during events (100° reference day)
 - 20% summer efficiency savings (compared to 2007)
 - 25% summer bill savings
 - 80% satisfied customers

* *EEDR = Energy Efficiency + Demand Response*

+ Background:

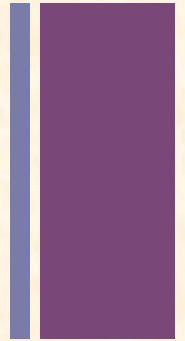
Phase 1 Residential Info & Controls

- 2009 Experimental Game
 - 450+ SMUD participants in a simulated home environment
 - Treatments: Real-time home vs. appliance energy use
- Results:**
 - Home energy info: **No savings**
 - Appliance info: **6% savings**

** Results of the simulation game. These results should not be compared to real-world results.



+ Presentation Outline



- Research Design
- Tasks & Schedule
- Technology
- Rate Development
- Recruitment and Installation
- Field Test
- Next Steps

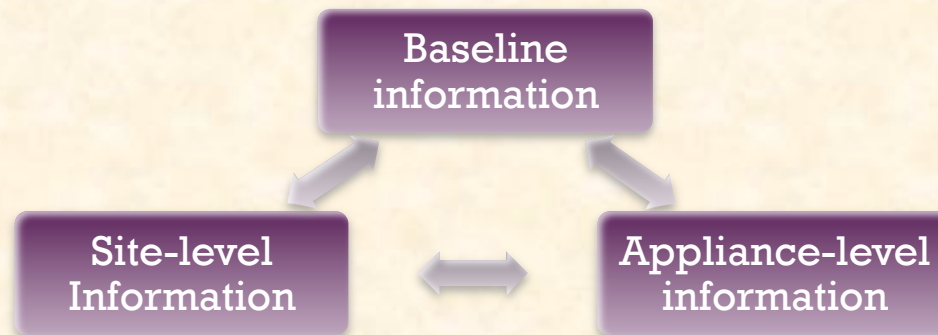


Research Design

+ Objectives

Determine effects on event kW and summer kWh of:

1. **Information Treatments** (randomly assigned)



2. **Rate** (customer chosen)



+ Hypotheses

- Peak demand is lower on event days than on non-event days
- Energy use and peak demand are lower in summer 2011 than in summer 2010
- Electricity bills are lower in summer 2011 than in summer 2010
- Demand impacts, energy impacts, bill impacts and satisfaction levels are higher for customers:
 - (a) with more information
 - (b) on the TOU-CPP rate
 - (c) on the automatic temperature control program
 - (d) with Tier 2 energy use
 - (e) with certain self-reported behaviors
 - (f) with certain dwelling characteristics
 - (g) with certain demographic characteristics
 - (h) with higher satisfaction levels (impacts only)

+ Tasks and Progress

	Task	Description	% done
1	Technology Review Memo	Document available energy information & controls systems. Issue RFP and choose one system for use in this study.	100%
2	Research Plan	Document research design, including objectives, tasks, and schedule.	100%
3	Recruitment	Design recruitment materials and recruit required treatment and control groups.	100%
4	Field Test Preparation	Conduct focus groups, design surveys, test RIC system, hire installers, etc.	100%
5	Field Test (2011)	Install RIC systems, start new rates, call events, provide customer support.	75%
6	Analysis & Reporting	Collect hourly data for participants and control group, conduct exit survey, analyze data and complete report.	0%



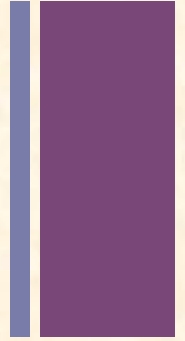
+

Technology

+ Technology Review: 50+ Vendors

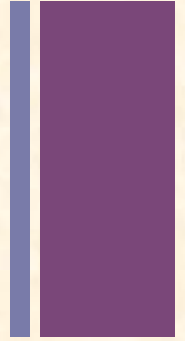
2 Save Energy, 4Home, Aclara, Agilewaves, AlertMe, Ambient, Ampy Email Metering, AzTech, Blueline Innovations, Calico, Converge, Control4, Current Cost Ltd, DIY KYOTO, Eco-eye, EcoDog, Efergy, eMeter, Energate, Energy Aware, Energy Inc, Energy Monitoring Technologies, EnergyHub, Enmetric Systems, General Electric, Google, Green Energy Options, Gridpoint, Home Automation Europe, Honeywell, iControl, In2Networks, Intel, JetLun, LS Research, Lucid Design Group, Microsoft, Onzo, OpenPeak, P3 International, Plugwise, Power House Dynamics, PowerMand, PRI, Residential Control Systems, San Vision Energy Technology, Seasonic, Shaspa, Silver Spring Networks, Tendril, Tenrehte, ThinkEco, Trilliant, USCL, WeatherWise, Wireless Monitors Australia Pty Ltd

+ Technology RFP – Requirements



- Allows SMUD to send price and load control event signals
- Aggregates and displays to customers the following real-time information
 - site electricity use (kW, kWh) and costs (\$, ¢/hr)
 - electricity use and costs for 110V and 220V appliances
 - electricity rate information (¢/kWh)
 - event notification from SMUD
- Is capable of initiating end-use controls on receipt of a price or event signal
 - price event offsets determined by the customer
 - load control offsets determined by SMUD
- Complies with SMUD's data security requirements
- Does not rely on Zigbee-SEP from the meter for any required functionality

+ Technology RFP – Process



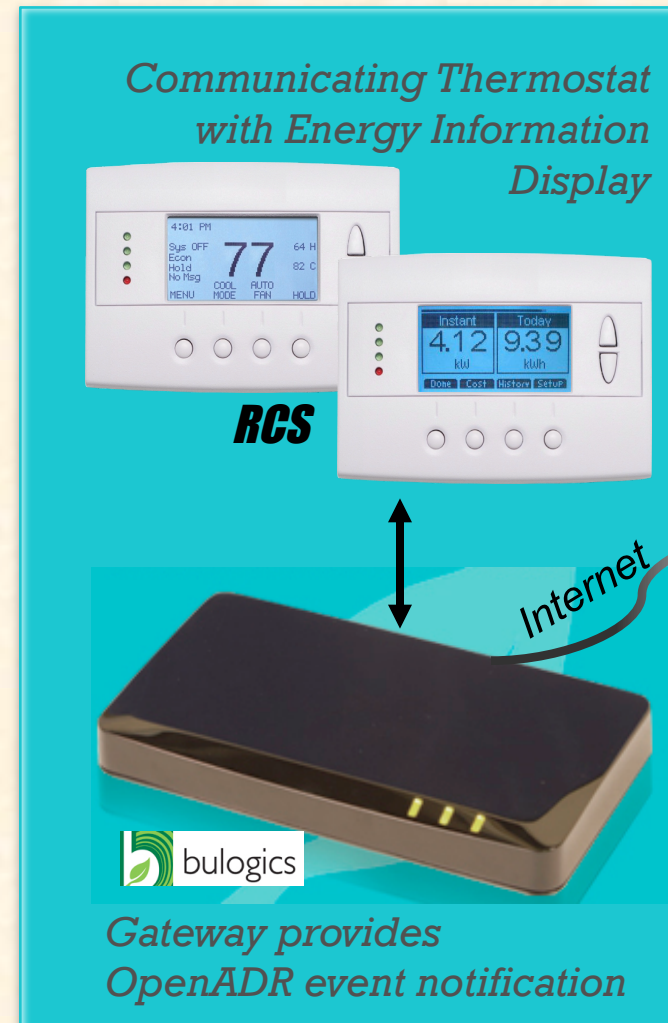
■ Objectives

- Modular system configurable to the 3 information treatments
- Flexible system able to send pricing
- Avoid Zigbee-SEP

■ 11 Proposals Received

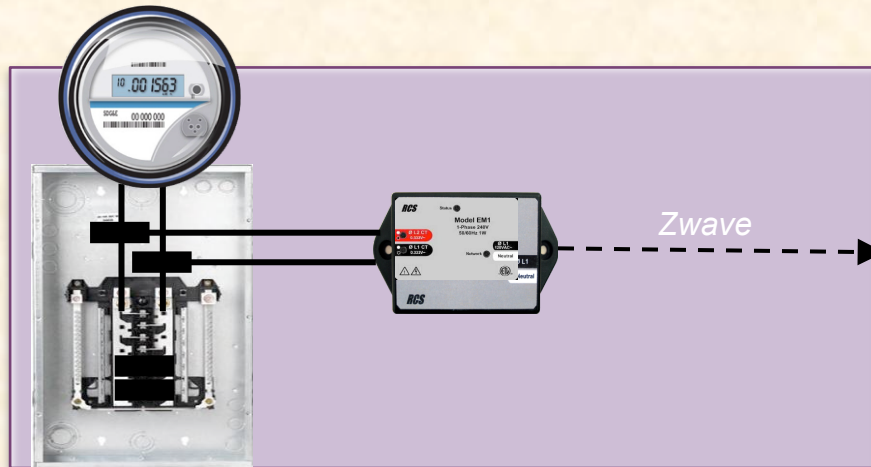
- 4 rejected for not meeting technical criteria
- 2 rejected for not meeting cost criteria
- 5 invited to SMUD for in-person demonstrations

+ Baseline System: Thermostat only

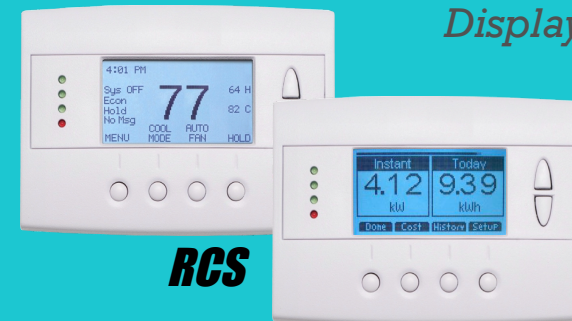


+ Energy Info System: Site Level

Site Data



*Communicating Thermostat
with Energy Information
Display*



RCS

Zwave

Internet

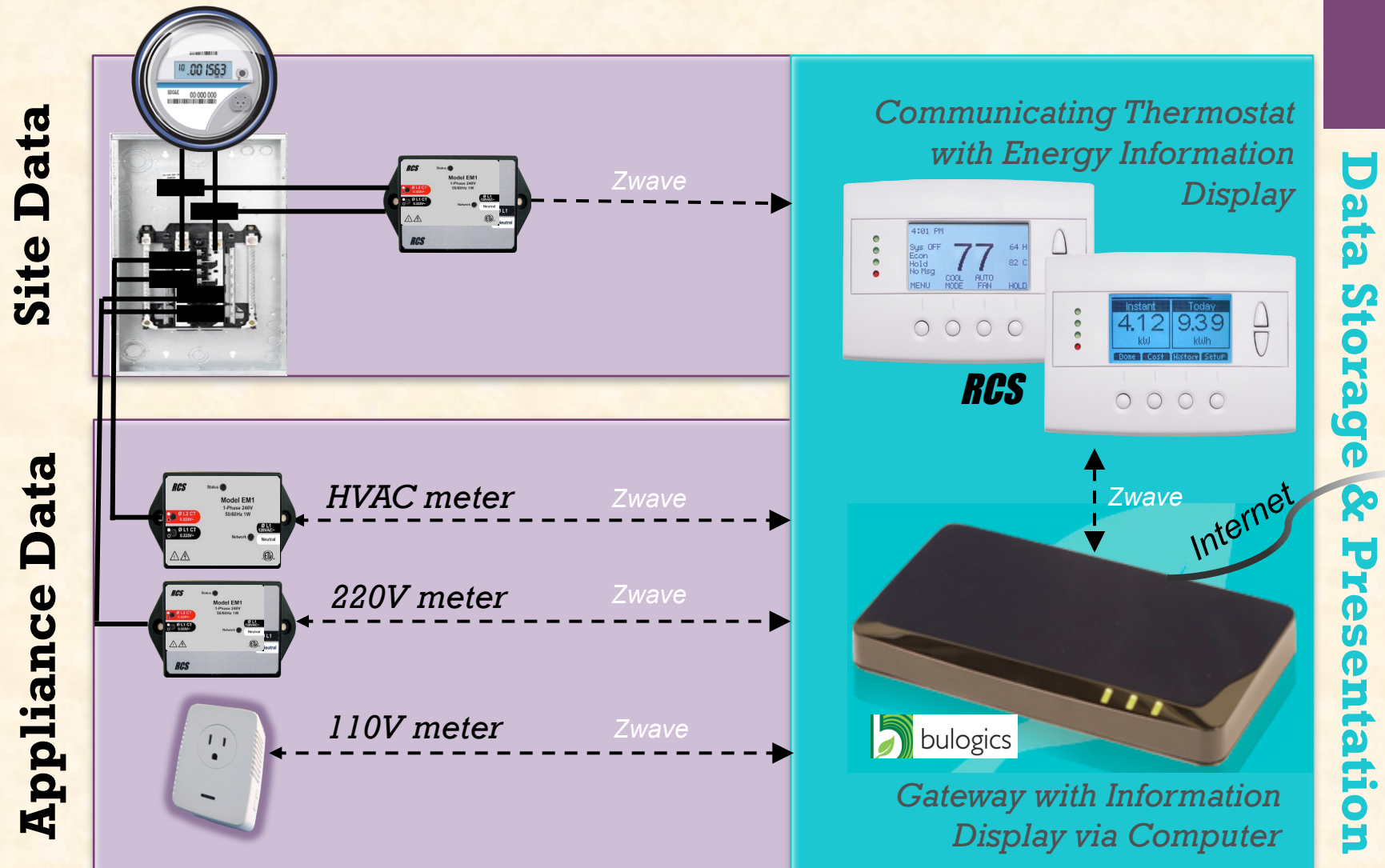


bulogics

*Gateway with Information
Display via Computer*

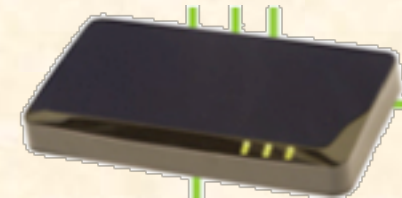
Data Storage & Presentation

+ Energy Info System: Appliance-level



+ System Flexibility

- Modular design – mix and match
- Multiple communications options
 - ZigBee, Zwave, WiFi, RDS on-board options
 - Usnap expansion modules for other options
- Local data storage; remote access optional
- Multiple display options
 - Thermostat
 - Computer
 - Mobile devices



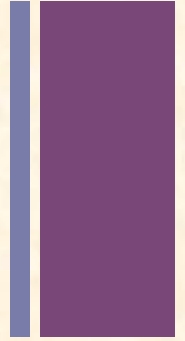
+ User Interface



+ User Interface



+ Technology Lessons Learned

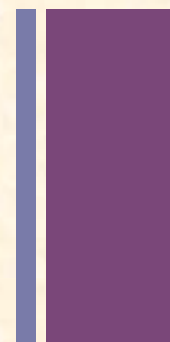


- Conduct usability testing before purchasing
- Make system requirements excruciatingly clear
- Purchase Extra Equipment
 - Add about 10% to system order to cover test sites and faulty units
 - Add about 20% to thermostat orders for two-thermostat homes
 - Add range-extending devices for about 20% of homes

+

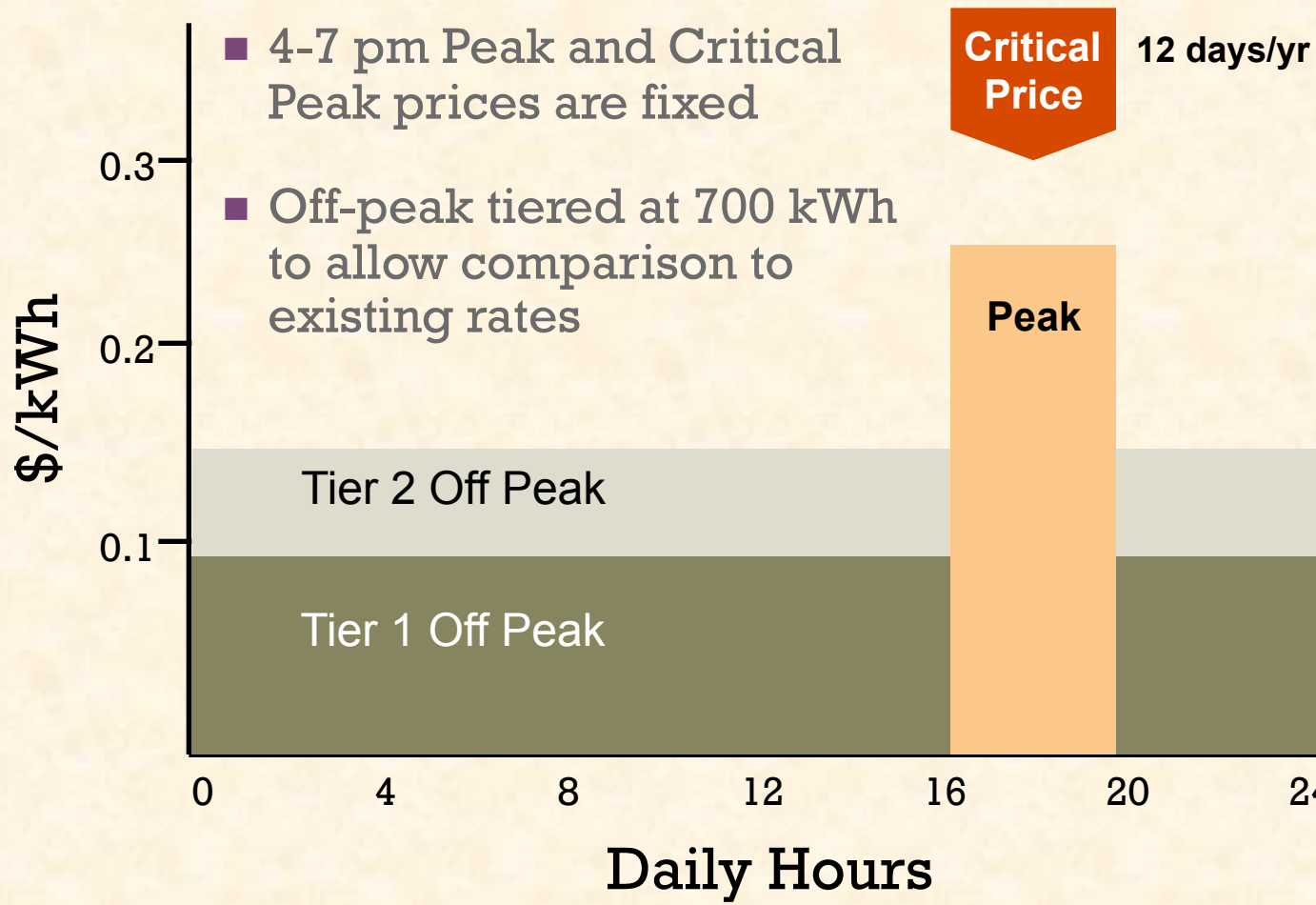
Rate Development

+ Battle of the Bills



Question	6-price adjustment	4-price actual
1 As of 10 am on Monday, your electricity use for this month was 652 kWh. What was your rate in the off-peak hour between 10 am and 11 am? [% correct]	72%	82%
2 As of 5 pm on Friday, your electricity use for this month was 724 kWh. Compared to your old rate, how much higher is your new rate in the peak hour between 5 pm and 6 pm? [% correct]	69%	31%
3 In what time period is electricity the cheapest? [% correct]	87%	90%
4 The presentation of rates and kWh information on this bill is... ["easy to understand" or "very easy to understand"]	26%	77%
5 The presentation of SAVINGS information is... ["easy to understand" or "very easy to understand"]	59%	72%
6 Which do you prefer?	18%	79%

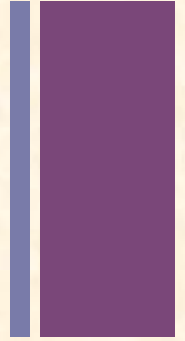
+ CPP Rate





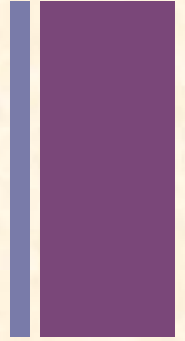
Recruitment and Installation

+ Recruitment – Overview



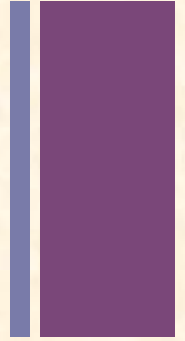
- Invitation mailings
 - March 31: 3000 customers (CPP+ATC options)
 - Follow-up phone calls made April 12-22
 - Reminder postcard mailed April 25
 - May 9: 1000 customers (CPP+ATC options)
 - May 25: 3000 customers (ATC option only)
- Summer Solutions recruitment website
- Dedicated Summer Solutions customer service phone line

+ Recruitment – Response Rates



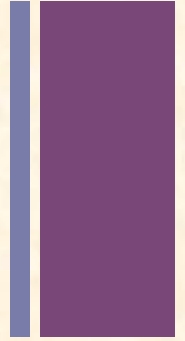
- Of all invited customers
 - 5.3% signup rate when two options were offered
 - 6.3% signup rate when only one option was offered
- Of Participants
 - 78% Chose the CPP rate over the standard rate
 - 65% Chose the ATC program
 - 11% Chose neither program (only equipment)

+ “No Thank You” Cards (35)



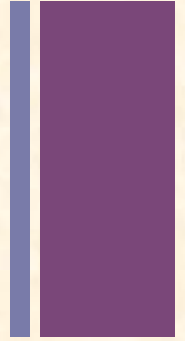
- No Internet access (13)
- Did not have time to review the offer (10)
- Read the information but didn't like the offer (5)
 - Loss of control
 - Too invasive
 - Already saving
 - Event price too high
- “I'm too old for this” (3)
- Renters (2)

+ Recruitment – Common Questions



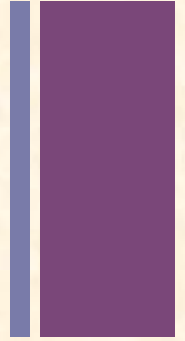
- Summer Solutions Program and Rates (40)
 - How does the program work? (23)
 - What are the rates? (14)
 - Can SMUD control my thermostat? (3)
- Equipment (41)
 - Thermostat instructions and programming (25)
 - Computer energy display access: (11)
 - Other (5)
- Registration and Appointment Logistics (38)

+ Recruitment – Lessons Learned



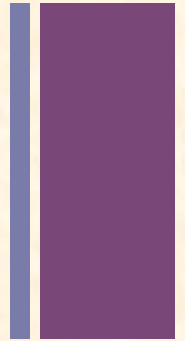
- Marketing
 - Keep it simple: fewer options = higher response rates
- Outreach
 - Follow-up postcards were (not) effective
 - Follow-up calls were (not) effective
- Plan ahead for delays
 - Recruitment material approval → printing → mailing: 2-3 months

+ Installation - Overview



- SMUD customer interaction training – required for all customer-facing contractors
- 6 beta installs to test process and customer interaction
- Detailed checklist for installers
- Installation complicated by
 - 3 mutually exclusive equipment types
 - 2 non-exclusive program options
 - Some equipment incompatibility

+ Installation – Lessons Learned



- Installer training
 - Require program-specific training for all installers
 - Accompany each installer on the first 1-2 customer visits
 - Have all program questions redirected to dedicated Summer Solutions Customer Service
- CT Installation
 - 5-10% of meter panels are not compatible with CT monitoring
 - Whole house power monitoring often requires cutting the utility cable
- Local Area Network Installation
 - D-Link routers are particularly problematic
 - Gateway IPs should be made static at the end of DHCP routing range and documented in the participant database
- Wireless Mesh Network Installation
 - ZWave works but has limitations, especially on larger homes
 - Occasional interference with existing wireless devices

+ Final Participant Sample

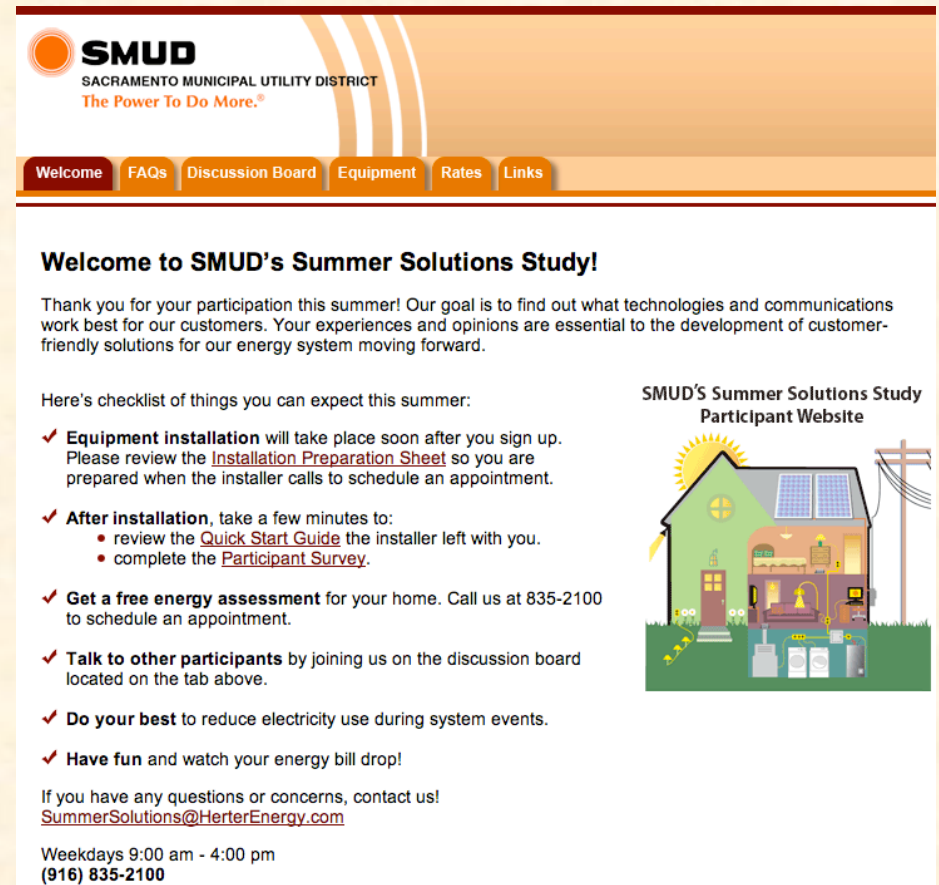
	HEMS	Home	Tstat	Total	ATC
Standard rate	41	48	41	130	81
Summer Solutions rate	47	41	47	135	91
Total	88	89	88	265	
ATC	58	57	57		172



Field Test

+ Participant website

- Links participant materials and customer survey
- Frequently Asked Questions
- Discussion Board
- Equipment info (3 versions)
- Rates info
- Links to rebates and info
- Customer Service contact info



The screenshot shows the SMUD Summer Solutions Study Participant Website. The header features the SMUD logo (Sacramento Municipal Utility District) with the tagline "The Power To Do More." Below the logo is a navigation bar with links: Welcome, FAQs, Discussion Board, Equipment, Rates, and Links. The main content area is titled "Welcome to SMUD's Summer Solutions Study!" and includes a thank-you message and a checklist of things to expect this summer. The checklist items are: 1. Equipment installation will take place soon after you sign up. Please review the [Installation Preparation Sheet](#) so you are prepared when the installer calls to schedule an appointment. 2. After installation, take a few minutes to: review the [Quick Start Guide](#) the installer left with you. complete the [Participant Survey](#). 3. Get a free energy assessment for your home. Call us at 835-2100 to schedule an appointment. 4. Talk to other participants by joining us on the discussion board located on the tab above. 5. Do your best to reduce electricity use during system events. 6. Have fun and watch your energy bill drop! Below the checklist, there is a contact information section: "If you have any questions or concerns, contact us! SummerSolutions@HerterEnergy.com Weekdays 9:00 am - 4:00 pm (916) 835-2100". On the right side of the main content area, there is a graphic titled "SMUD's Summer Solutions Study Participant Website" showing a house with solar panels, a utility pole, and a car.

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.®

Welcome FAQs Discussion Board Equipment Rates Links

Welcome to SMUD's Summer Solutions Study!

Thank you for your participation this summer! Our goal is to find out what technologies and communications work best for our customers. Your experiences and opinions are essential to the development of customer-friendly solutions for our energy system moving forward.

Here's checklist of things you can expect this summer:

- ✓ **Equipment installation** will take place soon after you sign up. Please review the [Installation Preparation Sheet](#) so you are prepared when the installer calls to schedule an appointment.
- ✓ **After installation**, take a few minutes to:
 - review the [Quick Start Guide](#) the installer left with you.
 - complete the [Participant Survey](#).
- ✓ **Get a free energy assessment** for your home. Call us at 835-2100 to schedule an appointment.
- ✓ **Talk to other participants** by joining us on the discussion board located on the tab above.
- ✓ **Do your best** to reduce electricity use during system events.
- ✓ **Have fun** and watch your energy bill drop!

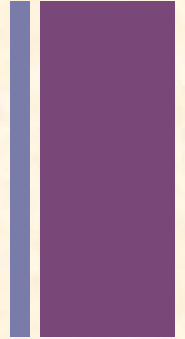
If you have any questions or concerns, contact us!
SummerSolutions@HerterEnergy.com

Weekdays 9:00 am - 4:00 pm
(916) 835-2100

SMUD's Summer Solutions Study Participant Website



+ Events – Overview



- 12 planned from July to September
- Notify Participants
 - Email – including recommendations for participant action
 - Thermostat display – blinking light and message
 - Computer energy display – ACTIVE event status displayed
 - Special requests: Phone calls or text message
- Notify Equipment
 - OpenADR to gateway
 - ZWave from gateway to thermostat

+ OpenADR Interface

DR Automation Server: Price Server System

https://smud.openadr.com:443/pss2.website/eventDetail.do?dispatch=create&programar

Welcome hertereenergy | SMUD | Logout 07/27/11 14:02:24

Demand Response Automation Server

Programs Participants Clients **Events** Reports Options About


Program SMUD DA


Event Date: 7/28/11

Start Time: 16 : 0 : 0

End Time: 19 : 0 : 0

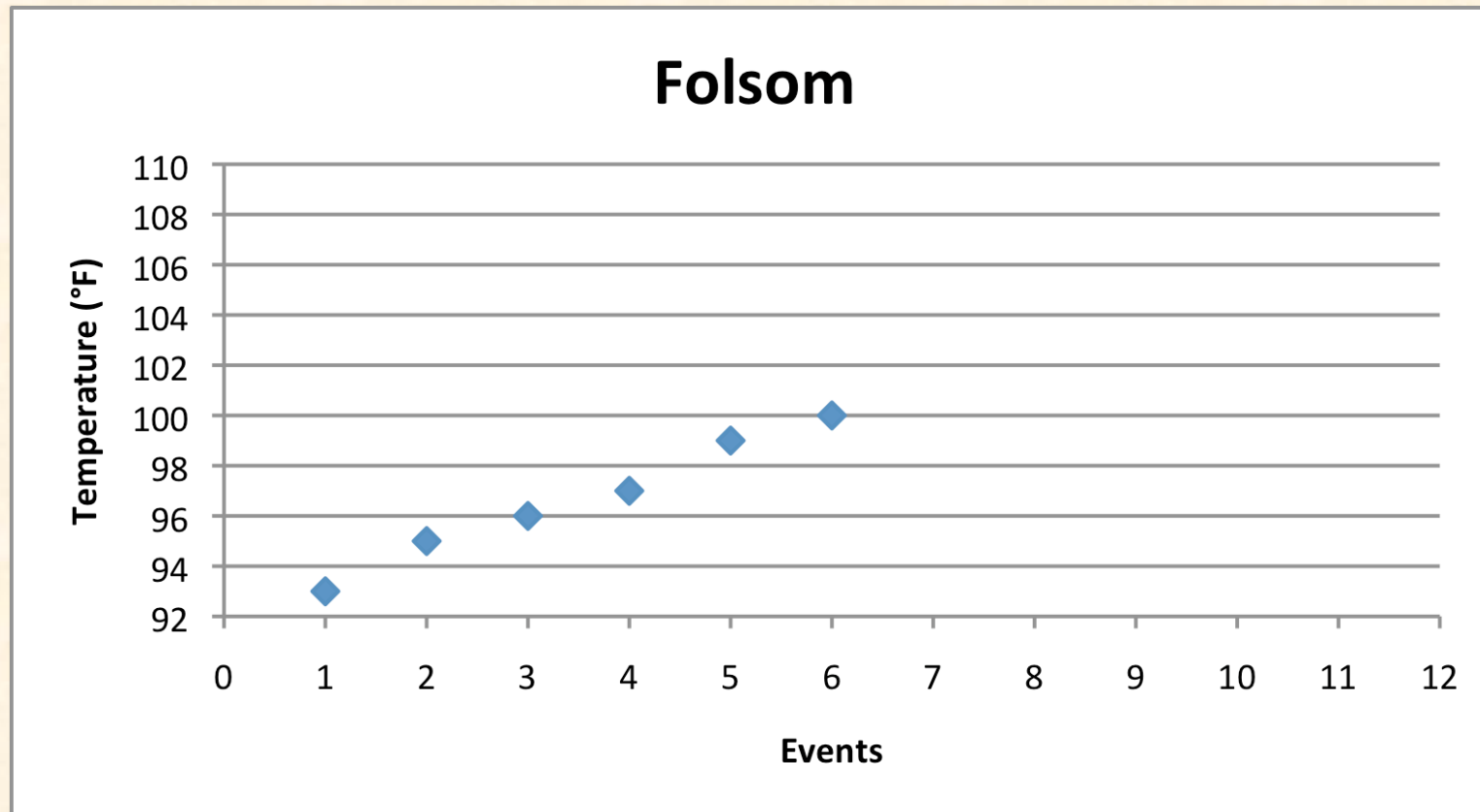
Create Event Cancel

 **SMUD**
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.®

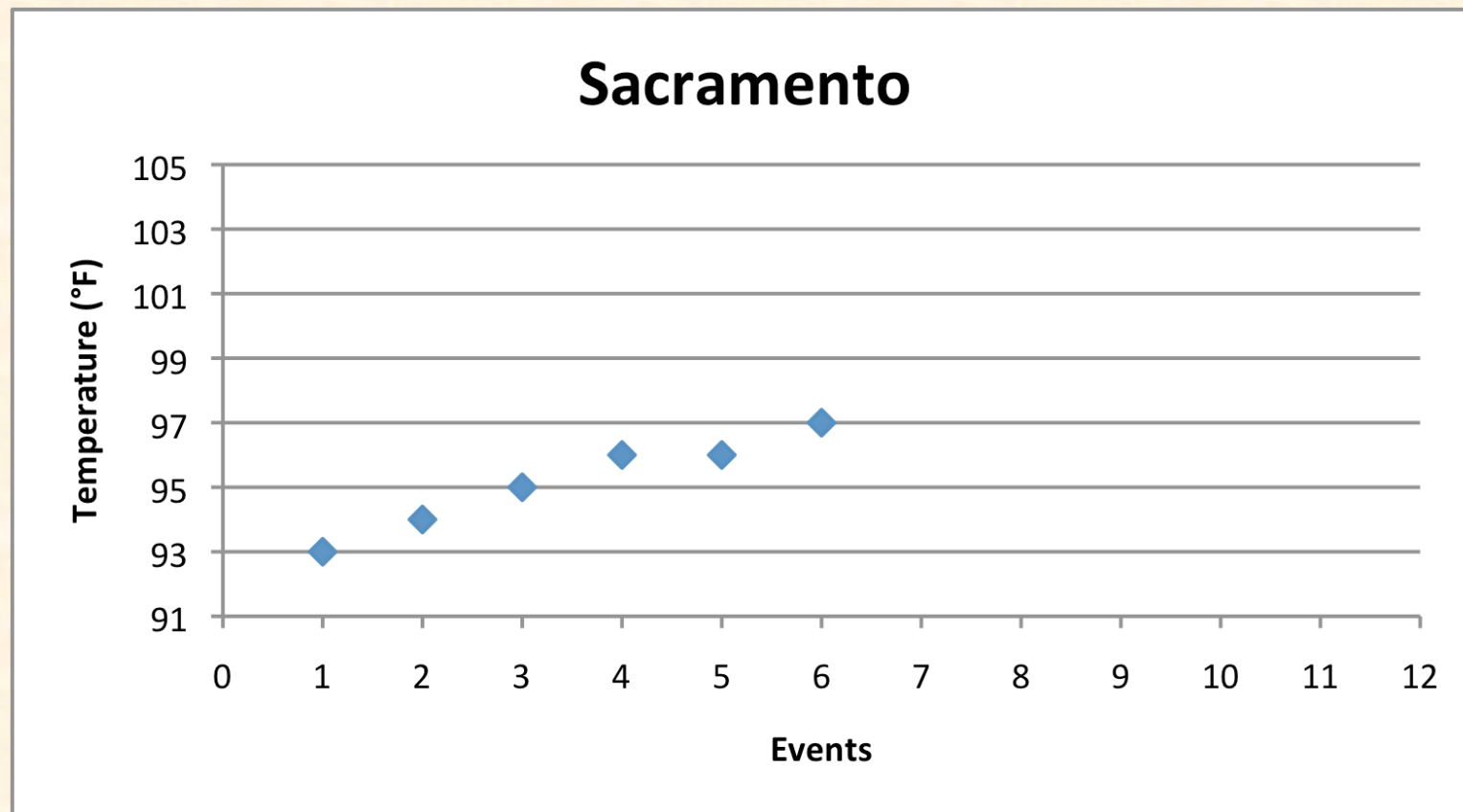
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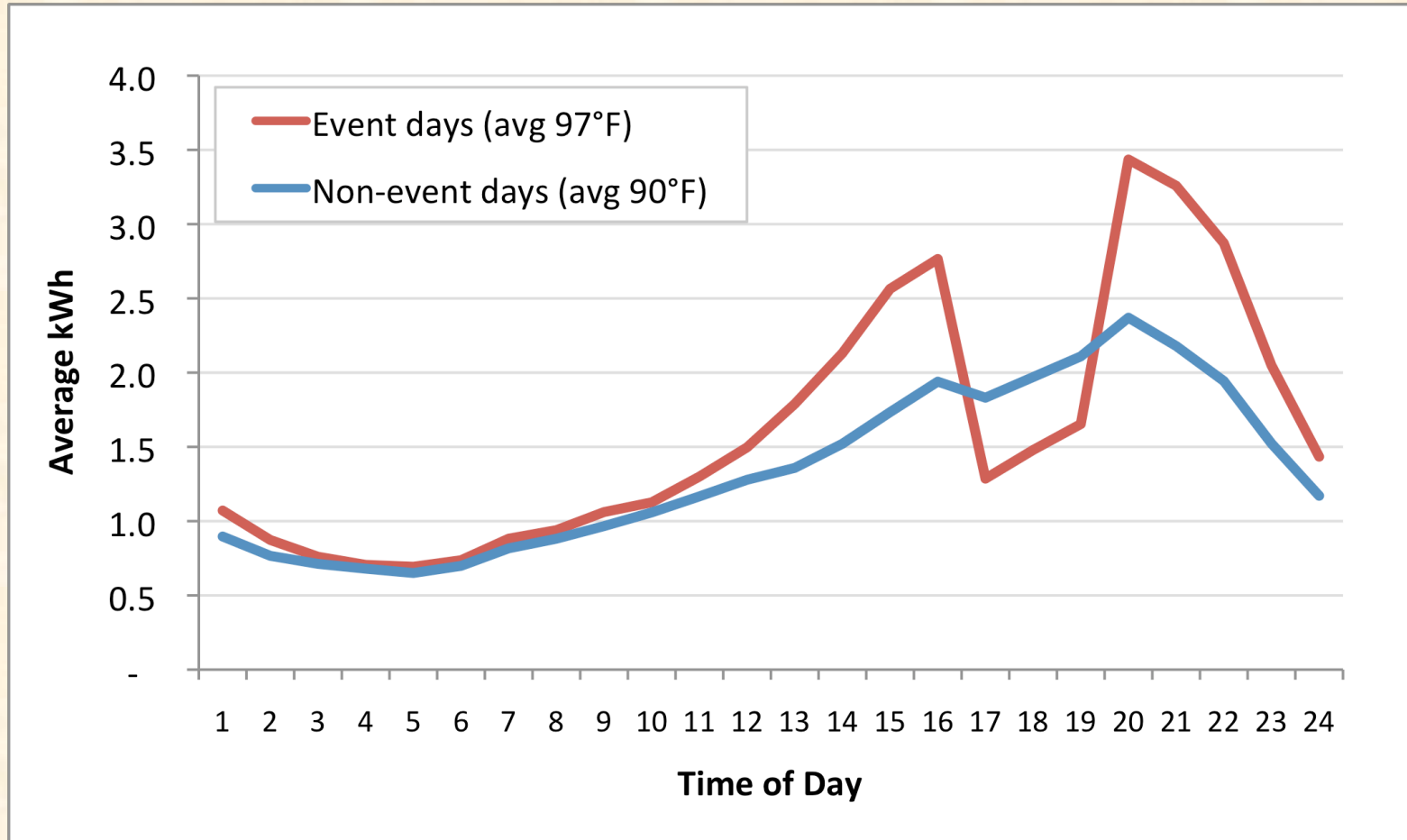
+ Events – Folsom Temperatures



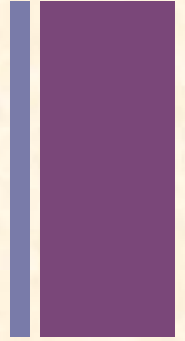
+ Events – Sacramento Temperatures



+ July Data: Not Weather-Normalized



+ Remaining Steps



- September 2011 – Test-run draft regression model
- October 2011 – Impact evaluation with final model
- November 2011 – Draft Report
- December 2011 – Final report

+ Karen@HerterEnergy.com

916.397.0101